

# LINTRONIC



**The New  
Generation of Electronics**

**Digital Microprocessor Technology**



# Knowledge and expertise



**Linde – the pioneer**  
**Linde products have been leaders in the field of mobile hydraulics for years.**

Our customers rely on our know-how. Many thousand pieces of equipment have been equipped with Linde technology.

Linde electronics engineers are masters of their craft – whether it's a matter of improved power utilization, or the best possible interaction among the components in the system as a whole, or user friendliness and safety.

The interaction of Linde's hydraulic and electronic components goes far beyond pump and diesel management – it opens up the option of managing the entire vehicle or piece of equipment:

**Hydraulic components + electronic components from Linde = complete vehicle management through the complete Linde system.**

The electronic load-limiter controls the whole range of load on the diesel engine. The maximum power of the diesel engine is available at any instant during its cycle. This will maximize the engine's performance while minimizing oversizing of the engine.

**Linde offers electronic systems for open and closed loop hydraulic applications.**

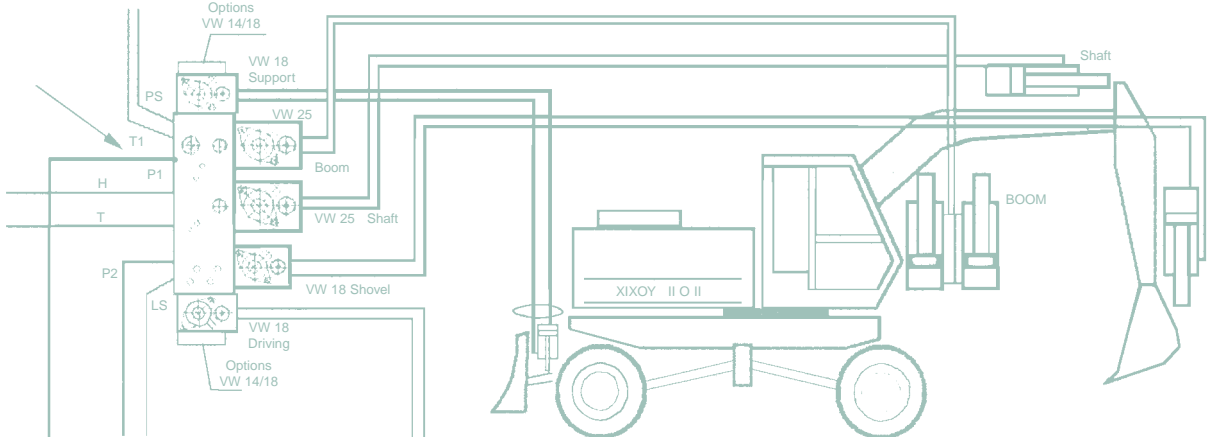


# Become a world market leader with Linde hydraulics and electronics

Linde – the pioneer in mobile hydraulics – discovered and perfected hydrostatics as the ideal type of actuation for mobile machinery. Since 1959, Linde has equipped more than two million vehicles in the fields of

- Construction equipment
- Agricultural machinery
- Forestry equipment
- Municipal vehicles
- Materials-handling technology

with hydrostatic driving and working actuation systems. The use of this actuating system in our own fork lift trucks made Linde the **world market leader!** And our **electronics** played an important part in doing that.



## Application Areas



# Electronic control unit for open loops

# CEB-14

## Electronic control unit CEB-14 for open loop hydraulic systems with load-sensing and mechanical diesel speed control

### System Description

The **CEB-14** electronic control unit includes the following functions:

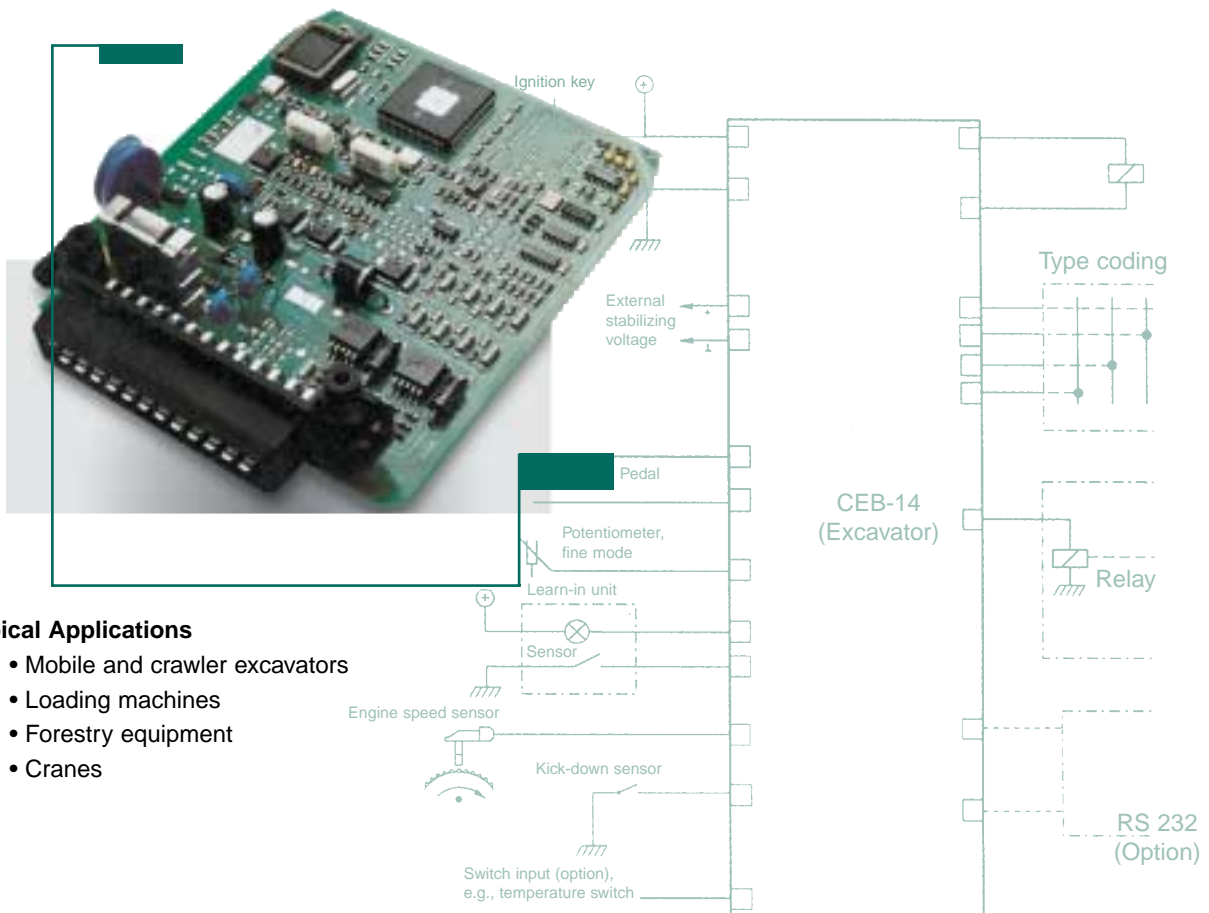
- Digital load-limit sensing control for working and driving, with mechanical diesel speed control
- Fine control function (fine mode)
- Semi-automatic equalization of the speed control device (learn-in function) for startup and service
- Diagnostics and fault display for component malfunctions
- Type programming via wiring harness bridges, coverage of a complete product line (up to 16 diesel engines with different sets of parameters)

### Function Description

- Diesel speed measurement
- Diesel speed control
- Load-limit sensing control
- Fine mode setting
- Mode lock-on in idling speed range
- Driving
- Learn-in function

### Components

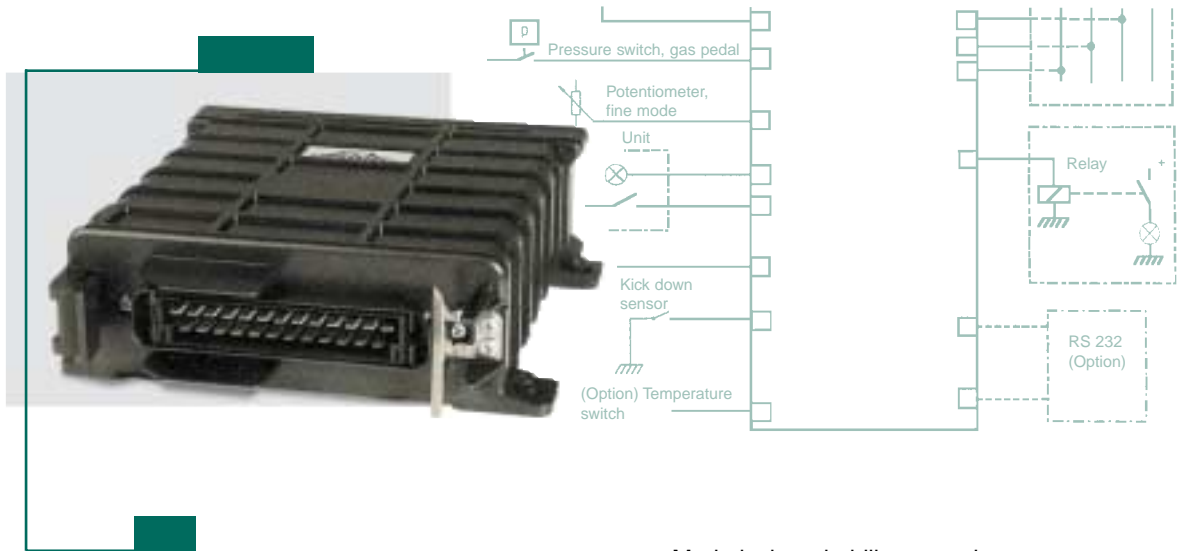
- CEB-14 electronics box
- Mechanical diesel speed control, including set-point potentiometer
- Diesel engine speed sensor
- Fine mode potentiometer
- Accelerator pedal pressure switch (control pressure)
- Learn-in button with control lamp
- Load-limit sensing control [GLR] relay
- Kickdown sensor (integrated into hand lever)



### Typical Applications

- Mobile and crawler excavators
- Loading machines
- Forestry equipment
- Cranes

# Electronic control unit for open loops **CEB-15**



**Electronic control unit CEB-15 for open loop systems with load-sensing control and diesel speed control with electrohydraulic linear actuator or electric motor diesel actuator**

- Mode lock-on in idling speed range
- Driving
- Teach-in function
- Load-limit sensing control malfunction lamp/diagnostics
- Programming of engine type
- ISO CAN bus capability (option)
- Temperature limitation for diesel and hydraulics (option)

## System Description

The **CEB-15** electronic control unit includes the following functions:

- Digital load-limit sensing control for working and driving via the VD-3 valve
- Preselection of speed and fine mode by means of potentiometer or via CAN bus
- Electric diesel speed control and regulation via linear diesel actuator CHX-01/05 or DC servomotor or analog signal (PWM)
- Automatic storing of speed control characteristic curve drift in work pauses
- Automatic idle, can be switched off
- Over-temperature limitation for diesel and hydraulic oil via temperature switch
- Sixteen engine types can be set via wiring harness bridges

## Function Description

- Diesel speed measurement
- Speed setting
- Diesel speed control
- Load-limit sensing control
- Fine mode setting

## Components

### 1. Basic version

- CEB-15 electronics box
- Electrohydraulic diesel actuator
- Potentiometer (diesel speed)
- Potentiometer (fine mode)
- Speed sensor (diesel engine)
- Pressure switch, auto-idle high pressure
- Auto idle preselector switch (on/off)
- Accelerator pedal pressure switch (control pressure)
- Teach-in button with control lamp
- Load-limit sensing control relay

### 2. Options

- Electric diesel speed control with position acknowledgement in lieu of electrohydraulic linear diesel actuator
- Transmission of programmed values and information on available system electronics via ISO CAN bus (system components can be used jointly)
- Temperature switch for cooling water / hydraulic oil



# Electronic control unit for closed loops



**CED electronic driving control unit for closed loops with accelerator pedal for diesel speed control by means of electrohydraulic or electric motor (EMR) diesel actuator**

With the **CED** electronic control unit, hydrostatic systems can be used for the widest possible range of applications. The CED can be used in construction equipment, agricultural machinery, forestry equipment, municipal vehicles and materials-handling equipment.

## The functions of the CED driving control unit

- Driving function (e.g., automotive)
- Preselection of travel direction
- Inch function
- Braking behavior
- Zone spreading (resolution)
- Preselection of types of operation
- Diesel speed control
- Pressing regulation
- Type programming
- Various options available
- 12V – 24V operation
- Diagnostics (ISO interface)
- Speed control (Tempomat)
- Transmission ratio control

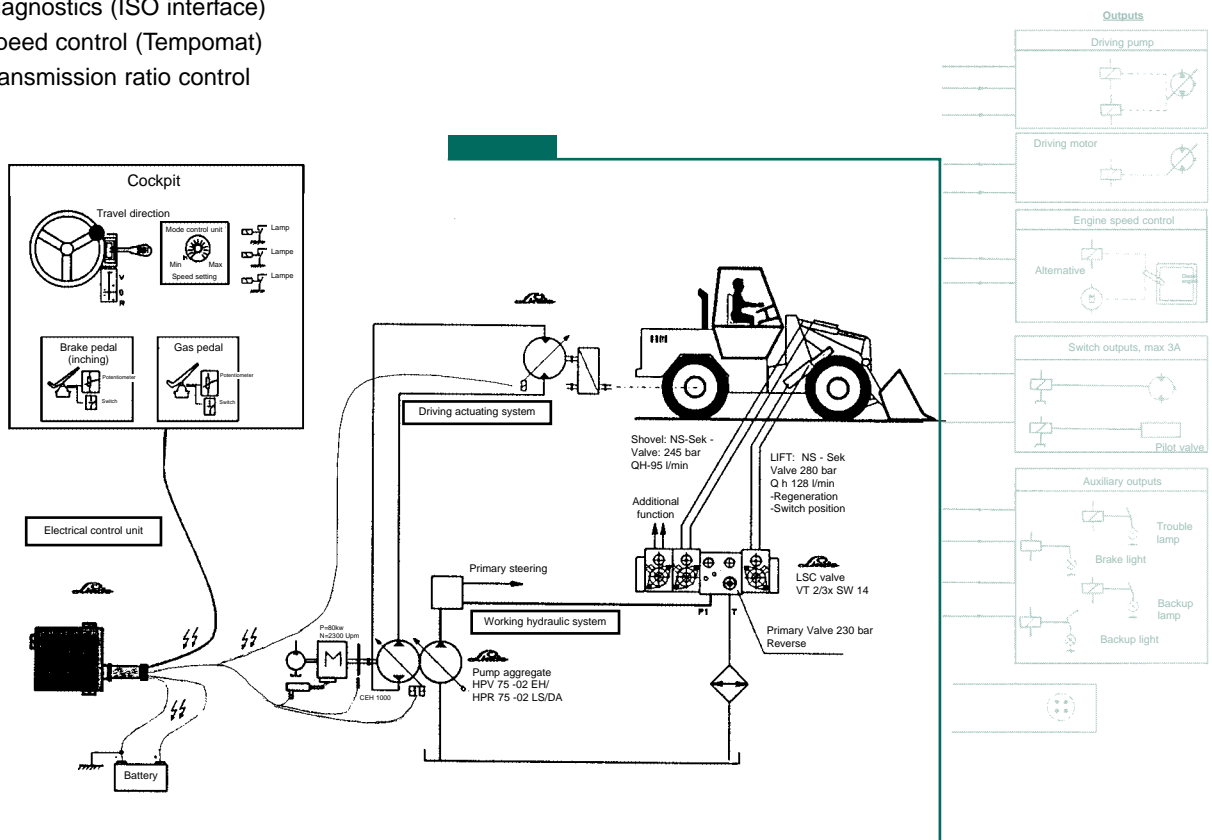
**Linde CED electronic control unit for closed hydraulic loops**

## 1. Basic version / components

- CED electronics box
- Accelerator pedal (including switch)
- Diesel speed sensor
- Travel direction switch

## 2. Options / components

- Selector switch for type of operation
- Inch pedal (including switch)
- Electrohydraulic diesel actuator; alternative: electric servomotor (EMR)
- Pressure switch (for increasing engine speed)
- Additional potentiometer (e.g., for v limitation)
- Vehicle speed sensor
- Temperature switch, cooling water/hydraulic oil
- Pressure sensor (high pressure)
- Auxiliary inputs (e.g., for brake lights)
- ISO interface for diagnostics
- Can be used with 12V or 24V electrical system
- Work hydraulics included in the control system logic



# Electronic control unit for closed loops

# CED



## High reliability and availability

High operational reliability, resulting from experience and hard use in construction machinery.

## Management of the complete hydrostatic system of actuating motor and hydrostatic driving hydraulic system by just one single electronic control unit

Best possible utilization of engine power into driving performance. High functional reliability. Maximum available motor power can be used (pressing regulation). Dynamic driving behavior optimized.

## Improvement of driving characteristics

Nearly the same driving characteristics with and without load, no change in speed when driving and working at the same time (e.g., lifting), i.e., compensation for the increase in speed of the diesel engine when working.

## Precise engine speed control at lower and upper idle (digital speed control)

Hardly any effort to adjust and service, no subsequent speed adjustment required.

## Integrated additional functions (switch outputs), for brake lights, backup flashers, etc.

These functions are preprogrammed.

## Adjustable driving behavior, parameterization via Linde test module or laptop

Adaptation of the driving characteristics to special usage conditions or customer requests.

## Operating parameter diagnostic capability via Linde test module or laptop

Simple, trouble-free monitoring of operating data.

## Optimum encapsulation of the electronics

Heat, dust, oil, moisture and water do not harm the control unit.

## Water-tight connector plugs; each connection line is individually sealed when in the connected state

High operating reliability, dependability and service life, even under unfavorable environmental conditions.

## Linde safety concept – 2 processors:

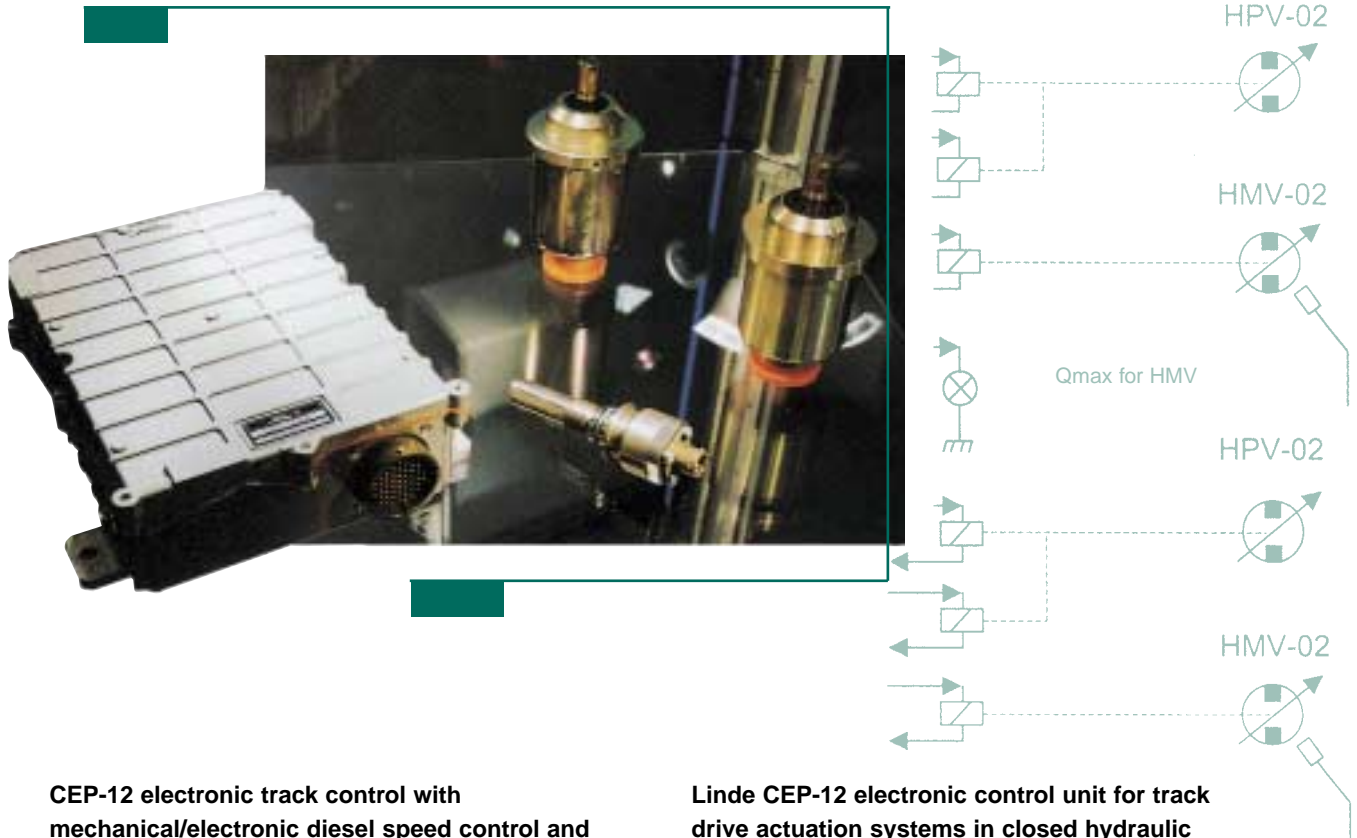
Function processor and safety processor  
The greatest possible functional safety, no unwanted driving functions if signals arrive incorrectly.

## Linde system concept

Hardware + software + hydrostatics come from a single source and are optimally matched to each other.

# CEP-12

## Electronic track control



**CEP-12 electronic track control with mechanical/electronic diesel speed control and four-quadrant driving transmitter**

### System description

Two-branch driving actuation systems (e.g., for bulldozers or loading tractors) can be controlled with the **CEP-12** electronic control unit. Driving and steering functions can be carried out with different transmitter configurations: four-quadrant transmitter (*driving/steering transmitter*), *driving lever in combination with two-pedal steering, driving pedal in combination with steering levers*. The electronics box includes the following:

### Functional characteristics

- Driving
- Zone spreading / load switching
- Steering
- Turning on one spot
- Pressing regulation
- Synchronization control
- Speed limiting
- Magnetic triggering of stopping brakes

**Linde CEP-12 electronic control unit for track drive actuation systems in closed hydraulic loops**

### 1. Basic version / components

- CEP-12 electronics box
- Mechanical/electrical diesel speed control  
Alternative: potentiometer sensor
- Diesel engine speed sensor
- Driving transmitter
- Load-switching button

### 2. Options

- Engine speed sensor 1\*
- Temperature sensors 2\*  
(cooling water / hydraulic oil)

Footnotes:

1\* Integrated into the hydromotor

2\* Alternative pressures sensors available



# Strict testing procedures for Linde electronic equipment

**Strict test procedures are indispensable in ensuring the proper and safe functioning of the electronic components**

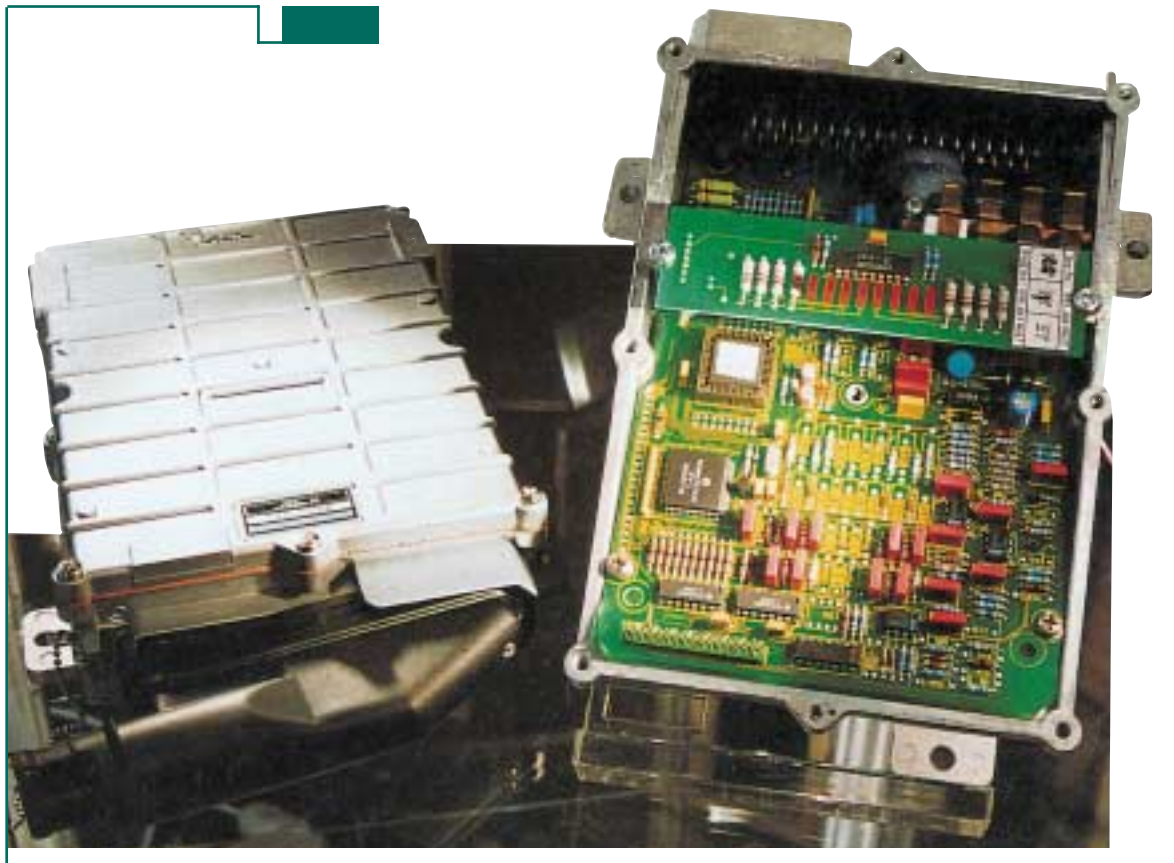
This is important in the case of well-proven components, but it is absolutely essential with electronic control units. The electronic brain contains the widest possible variety of information concerning its surroundings and transmits appropriate instructions in return.

In conjunction with that, the electronic control unit is dependent on reliable information from the outside in order to give out correct and reliable instructions.

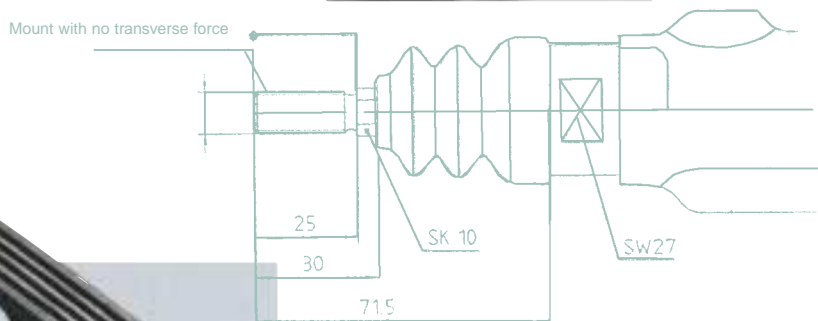
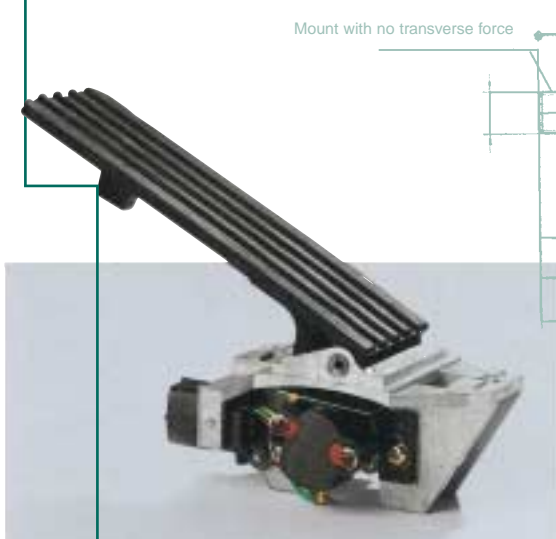
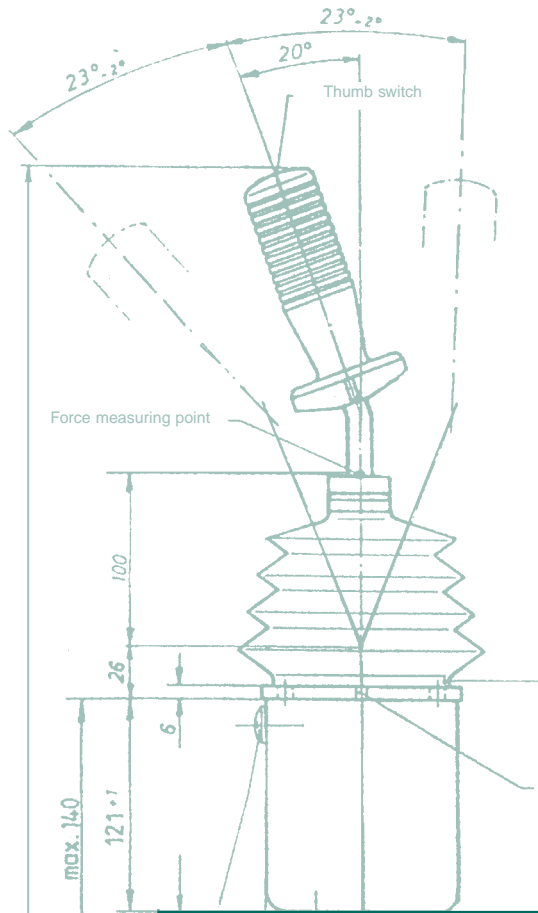
Linde observes all of the relevant regulations that result in extensive testing procedures.

Linde conducts the following tests for reliability and safety:

- Mechanical tests
- Electronic tests
- Function tests
- Safety tests
- System tests
- Field tests
- The following tests are carried out continuously during production of the system components:
  - *Visual inspection, IC test, check-sum test, run-in test*
  - *Visual inspections (100%) following assembly/installation of the electronic components and following the soldering operation*



# Peripheral components *LINDE*



Additional components for completing the system upon request.

## Here is how to reach us

Would you like additional information concerning Linde electronics?  
Talk with us! We're always there for you!

### Direct route to Linde Hydraulics and Electronics

You can reach us

- **By telephone** +49-60 21-99-0 (switchboard)
- **By fax** +49-60 21-99-42 02  
+49-60 21-99-42 30
- **By e-mail** [info.hydraulics@linde-mh.de](mailto:info.hydraulics@linde-mh.de)
- **By internet** [www.linde-hydraulics.com](http://www.linde-hydraulics.com)
- **By mail** Linde AG  
Linde Material Handling Division

Grossostheimer Strasse 198  
D-63741 Aschaffenburg

PO Box 10 01 36  
D-63701 Aschaffenburg



# The New Generation of Electronics



**Linde AG, Linde Material Handling Division  
Plant 2, Aschaffenburg-Nilkheim**